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(54) Universal interface module interconnecting various copiers and printers with various sheet output processors

Universalinterfacemodul zur Verbindung diverser Kopierer oder Reproduktionsgeräte mit diversen Blattausgabegeräten

Module interface universel pour interconnecter les copieurs ou les appareils de reproduction diverses entre les processeurs divers pour sortir les feuilles en output

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Description

The present invention relates to an interface for enabling the copy sheet output of a range of reproduction machines to be fed to a range of copy sheet processing units.

By way of background, there are a large number of copiers and printers on the market and on the drawing board today that are at different paper path heights and directions for input and output. Customers are desirous of greater compatibility with various commercial feeding/finishing equipment providing more on-line sheet processing options, with less manual sheet handling In the past, some copier designs called for the output sheets to be delivered at a "standard" output height and side for that particular supplier, but often without regard to potential downstream equipment, leaving the task of delivering that sheet output to that other downstream device as the responsibility of that particular paper handling accessory equipment supplier [of which there are more than 24 multi-nationally]. Also, the sheet feeding rates (in copies per minute. or cm. per second) are often not compatible. The number of possible combinations is staggering. Although a "standard" paper path height agreement at 860mm (measured from the floor) with some finishing suppliers has been proposed, even if accepted, that could undesirably force compromise of other copier, printer or finisher design features.

There is extensive and longstanding patent prior art on various specialized partially variable level copier-to-sorter or internal sorter variable bin level sheet transports, and some patent art on interface modules (examples are cited below).

Of particular background interest on the general subject of interface modules is U.S. patent No. 5,172,162. Col. 2, lines 29-44 of this 5,172,162 patent incidentally acknowledges the problem of printer/accessory unit height incompatability addressed herein. However, that patent does not provide any actual teaching of any solution to that problem. [This patent primarily addresses possible internal sheet handling features within such an interface module, such as a purging system.]

The following additional U.S. patents are also noted as disclosing interface modules with sheet transports: 4,602,775 on a modular unit providing for cover insertion and sheet inversion taking input on one side from a copier and providing output on the other side to a finisher (but at the same level); 5,145,168 (Fig. 1, interface module 80); 5,137,270; 4,602,776 (inserter module 45); 4,830,356 (module 70 in Fig. 7); 4,353,543; 4,515,458, (interface unit 103, e.g., Col. 5, lines 22-23); 3,848,867 (interface unit 12); 4,615,521; 3,963,235; and 4,700,940.

German Patent application DE 3718-131-A1, "Transfer Jig for Handling Film Sheets" is noted here as of interest structurally for its input/output height adjustments, although it may be seen that this is from a different commercial area. U.S. 5,099,274 is similar. Of course, various other adjustable height conveyors are also known in other non-analogous arts, such as U.S. 2,490,381 on a sack conveyor and U.S. 3,071,237 on a pipe conveyor

Of interest re left or right side sheet input is U.S. 4,691,914 which discloses a plural bin random access [with plural solenoids] sheet receiver. It discloses sheet input from both the right or left sides, indicated as from a copier and a printer respectively. U.S. 3,866,904 shows inserting sheets into a set of sorter bins from opposite sides thereof for simplex or duplex copies, respectively for, or without, inversion, but all copies enter from one side of the sorter module. U.S. 5,056,768 is noted re selectable right or left hand printer output.

As noted above, there is also extensive patent prior art on telescoping and/or pivoting input paths inside a sorter or connecting from a copier to the various levels of bins of a vertical bin array sorter. and/or from variable copier input heights. Examples include: U.S. patents 3,853,314: 3,963,235: 3,944,217: 4,615,521: 4,700,940: 5,099,274: 4,322,069: 4,548,403: 4,580,775: 4,671:505: 4,828,415; 4,881,730: 4,900,009: 4,913,426: 5,101,241 and 5,172,905.

One optional output device connected to or by the UIM can be a "mailbox" unit. "Mailboxes" can can provide discrete bins for received hard copies of several different job recipients of shared user printers. Mailbox units may include locked "privacy doors" for certain designated bins which may have electronically controlled bin unlocking, for private bin security. A mailbox output unit allows plural recipients to share the same printer and/or facsimile or the like receiver, without disclosing, compromising or commingling their separate jobs and/or correspondence. A stand-alone "mailbox" or addressable sorter can automatically sort and file various output documents ("hard copies", i.e., physical sheets) in discrete designated bins, which can optionally be secured.

."Mailbox" bins or other stackers desirably can store plural finished or bound (e.g. stapled) sets in one or more selected assigned mailbox bins. Thus, any particular user-designated bin can store plural stapled sets from the same or different jobs. Noted in this regard is U.S. 5,098,074, especially Fig. 4 and its description, and the last paragraphs, and the corresponding abstracted "Xerox Disclosure Journal" publication Vol. 16, No. 5, pp. 281-283 dated Sept./Oct. 1991.

The alleged utility of otherwise conventional existing sorters for [unlocked] printer output sorters or "mailboxes", and printer "mailboxing" in general, is briefly discussed in U.S. 4,843,434; U.S. 4,763,892 and U.S. 4,051,419. Of further "mailbox" interest is U.S. 5,141,222 (and its equivalent EPO Application No 0 399 565).

Other sheet processing options can include providing enhanced job set finishing functions. For example, stapling and/or other binding, punching, folding, special

sheet inserts or booklet making, and stacking or sorting of either finished or unfinished sets. Further art examples are cited hereinbelow.

It is additionally noted that combined facsimile and/or other digital scanning or copying, receiving and printing (and even additional conventional light lens, or digital, copying) can be provided in one single unit, encompassed by the term "printer" as used herein.

By way of further background on other output devices (copy sheet processing units), sorters with in-bin set stapling for finishing are well known.

Typically, the stapler unit moves or pivots partially into each bin and staples each set therein, or the compiled set is moved slightly out of the bin, stapled and moved back into the bin, or the bin moves or pivots into the stapler unit.

By way of further background, one cannot staple output job sets until after they are collated. Thus, for *post*-collated *copier* output, a *sorter* must fill all the required bins with all the copies of the job before stapling any of them. On the other hand, *pre*collation copying, by using an RDH or an electronic printer, allows the job sets to be printed out as pre-collated job sets and delivered as such to an individual bin and finished one set at a time.

A printer, copier or facsimile or the like reprographic system providing printed sheet output herein is encompassed by the terms "printer" or "reproduction machine". In the description herein the term "sheet" or "hard copy" refers to a usually flimsy sheet of paper, plastic, or other such conventional individual physical image substrate, and not to electronic images. Related, e.g., page order, plural sheets, documents or copies can be referred to as a "set" or "job". A "job" may also refer to one or more documents or sets of documents beings sent to or received by a particular addressee or designee. The term "copy sheet" or "output" or "output sheets" herein is still generally used to refer to the paper or other such typical flimsy physical image substrate sheets outputted by a reproduction apparatus, such as a xerographic copier or printer, and whether imaged or printed on one or both sides. These output sheets are now often, of course, not literal "copies" in the old-fashioned sense, since the term now may also encompass computer-generated graphic images (as well as various text) for which there is not necessarily a *physical* "original" being copied optically or electronically scanned, although that is also encompassed by the term "copy" or "output" sheets here. The term "document", unfortunately, unless defined, is used ambiguously in the art by others to refer to either a single page or multi-page set or job, especially (but not always) as that which being transmitted or copied. "Original" is more specifically used for the latter.

It is an object of the present invention to provide an improved interface for operatively connecting and feeding the sequential copy sheet output of various selectable reproduction machines of widely varying ranges of sheet output level heights and direction to various selectable independent copy sheet processing units having widely varying sheet input level heights.

The present invention provides an interface as claimed in any one of the accompanying claims.

The disclosed modular interconnect device provides a simple but wide-range independent adjustment of its sheet input and output heights or levels, and repositioning inter-connecting sheet path, to operatively connect between almost any existing or future printed sheet output and sheet processing units, irrespective of the sheet input and output heights or levels of those units. It is thus referred to herein a "Universal Interface (or transition) Module" or "UIM". In particular, the subject UIM provides a paper path sheet transport between almost any reproduction apparatus and almost any finisher or other sheet processing apparatus, irrespective of wide variation or differences in their sheet output and input levels or direction.

The UIM disclosed herein can provide one "standard" transition module to connect with all feeding and finishing partner products, regardless of input/output height or direction. It can provide a significant cost (UMC) reduction by enabling production of only one identical module (and spare parts) in volume quantities. versus many different specialized interconnect transport devices.

The embodiment of the invention disclosed below provides a single free-standing universal interface module which may be moved in between almost any copier or printer on one side and almost any finisher or other sheet processing accessory on its other side, which UIM provides both input and output level adjustments, independent of one another, over ranges mating to almost any such respective devices, as well as an automatic internal sheet feeding path length adjustment allowing that independent input and output level change, which automatic path length adjustment is inside this stand-alone module, yet which module can desirably have a defined (fixed) narrow width, so as not to add significant customer space usage or overall length to combined equipment, and have predictable dimensions for any customer usage.

The UIM apparatus disclosed in the example hereinbelow provides a telescoping paper path through the UIM that automatically adjusts in length as the selected sheet input and output levels are varied, without requiring any changes in the dimensions of the UIM itself, and yet remains desirably planar and provides positive sheet feeding, irrespective of changes in the UIM input and/or output level.

An additional feature of the embodiment described below is to provide a single modular UIM optionally enabling either left or right printer exit commonality. I.e., the ability to accept sequential sheet output from either right-exit or left-exit printers.

The disclosed universal interface unit can desirably be a free-standing movable stand-alone unit that is relatively low cost and light weight and very compact, that

may be attached to, or even simply moved next to, to dock or mate with, the output of almost any conventional copier or printer, including facsimile or combination (plural mode) machines, or networked electronic mail printers, or almost any such other reproduction apparatus, even desk-top or cart-mounted units on various levels of desks or carts.

The exemplary disclosed UIM internal sheet path may also desirably provides a variable speed but positive sheet feeding drive system that can provide automatic speed matching between various interconnected units or modules. This same UIM sheet path drive may also provide reversibility, for left or right side input and output.

A specific feature of the specific embodiment disclosed herein is to provide a universal interface for operatively connecting and feeding the sequential copy sheet output of various selectable reproduction machines of widely varying ranges of sheet output level heights to various selectable independent copy sheet processing units having widely varying sheet input level heights, comprising: a free-standing movable universal interface module of a fixed narrow width: said narrow free-standing universal interface module providing a repositionable sheet feeding path therethrough, from one side to the other of said module, for transporting said copy sheet output of said selected reproduction apparatus to said sheet input of said selected copy sheet processing module; said repositionable sheet feeding path through said universal interface module providing selectably reversible feeding of said copy sheets therethrough in either direction; said repositionable sheet feeding path through said universal interface module including integral vertically repositionable sheet receiving or sheet discharging sheet path ends opening at opposite sides of said interface module, which sheet path ends are readily independently repositionable over a large vertical height range; a retention system for retaining said sheet path ends at selected height positions mating with a selected reproduction apparatus sheet output level and a selected copy sheet processing unit sheet input level so that said repositionable sheet feeding path is operatively connecting therebetween to feed sheets from said reproduction apparatus to said copy sheet processing module.

Further specific features disclosed herein, individually or in combination, include those wherein said repositionable sheet feeding path has a variable path length varied automatically with said path ends vertical height repositioning, and/or wherein said sheet feeding path through said interface module remains substantially linear irrespective of said sheet path ends vertical height repositioning, and/or wherein said universal interface module has a constant width of less than about 40 cm, and/or wherein at least one of said sheet path ends of said interface module sheet feeding path is vertically repositionable over a vertical height range of at least approximately 50 to 100 cm, and/or wherein said sheet path ends of said interface module sheet feeding path are vertically repositionable over a vertical height range of at least approximately 50 to 100 cm, and/or wherein said repositionable sheet feeding path comprises a variable speed sheet feed drive automatically adjusting to sheet input speed, and/or wherein said sheet feeding path has an automatically reversing sheet feed drive, and/or wherein said repositionable sheet feeding path has a variable path length varied automatically with said path ends vertical height repositioning and wherein said sheet feeding path is defined by telescoping baffles automatically telescoping to provide changes in said sheet feeding path length, and/or wherein said sheet feeding path has a path length varying automatically with said path end height repositioning, and wherein said sheet feeding path through said interface module remains substantially linear irrespective of said sheet path end height repositioning. and wherein said sheet feeding path includes telescoping baffles automatically telescoping to provide said path length variations.

An interface in accordance with the present invention may optionally be used as a part of office systems for electronic mail hardcopy prints and/or other networked or shared user document prints in general E.g., in a shared user, networked, printer environment. such as in a modern office environment. the printer can electronically recognize the sender or user terminal sending the printing job from network or document electronic information, such as a "job ticket", already available in or with said electronic job and printing distributions, and process and output the hard-copies accordingly. (Such shared printers may also have alternate scanner or floppy disk document inputs.)

As to usable specific or alternative hardware components of the subject UIM apparatus itself, it will be appreciated that, as is normally the case, some such specific hardware components are known *per se* in other apparatus or applications. For example, various commercially available stand-alone, self-controlled modular sorter units are known for sorting the output of xerographic copiers or printers, with various hardware systems. Examples include above-cited art and its references.

By way of example only, an embodiment of the invention will be described with reference to the accompanying drawings, in which:

Fig. 1 is top internal schematic view of one example of a widely adjustable feed path for a UIM system and unit, for operatively connecting with and receiving the output of copy sheets of a conventional printer, shown by the input arrow. This UIM unit is shown here operating as an interface module receiving sheets at the left hand side for transporting output from the right end or side of printer apparatus to an exemplary output unit or module on the UIM right side. However, the printer output may alternatively be received at the left side of the UIM;

Fig. 2 is a cross-sectional view of the UIM of Fig. 1 taken through line "Fig. 2" thereof;
Fig. 3 is a frontal view with the covers removed of the UIM of Figs. 1 and 2;
Figs. 4 and 5 are similar to Fig. 3 (with the support rails in phantom for clarity) but with the feed path shown realigned in two different positions; and
Fig. 6 schematically shows a front view of one example of an overall printing and finishing system incorporating said UIM example, illustrating its small effect in the overall size of the combined unit; and also showing an additional said UIM between a finisher module and a mailbox and stacker module.

The disclosed universal interface module or UIM provides a simply but highly adjustable paper path transport that enables processors with widely differing sheet output position levels or heights to interface with a wide variety of other sheet processing units or modules of widely differing input levels or heights. Providing one single highly flexible and adaptable interface unit can eliminate substantial engineering time and work for separate specialized interfaces otherwise needed for a particular printing machine to feed its output sheets to a particular third party finisher. sorter. mailbox, folder or other sheet processing unit or module. These units can vary widely in output and input levels. Often the desired input is at the top or bottom, especially for sorters or mailboxes with a typical vertical sheet transport running past a vertical array of bins. The disclosed UIM readily provides for a variable input level which may be substantially different from its variable output level, and also provides for the resultant change in the sheet path length through the UIM.

Turning now to the UIM 10 shown in the Figures, it will be appreciated that this is merely an exemplary embodiment of the invention. The printer 12 to which this UIM 10 may be operatively connected is partially shown schematically, since various printers may be so connected, with no printer modifications, as part of various systems. The UIM adapts or adjusts to various printer output levels to sequentially feed the printer output sheets from the printer into the sheet input entrance of the particular output unit or units 11 currently being used by the customer. The units or systems described herein are merely exemplary. The general reference number 11 will be used throughout for any selected individual output unit, and 12 for any printer (which, as noted, may be a printer, copier, or other reproduction device).

The UIM 10 here provides a linear sheet feeding path 14 therethrough irrespective of its input or output height adjustments. This sheet feeding path 14 here has otherwise conventional frictional sheet feeding nips provided by sheet feeding wheels 13 [or belts] (with opposing idlers) preferably driven by a single reversible motor "M". The sheet path 14 is also defined and supported here by bi-directional generally planar telescoping sheet path baffles 20. These baffles 20 may be made of light weight relatively rigid plastic, or sheet metal. The baffles 20 may extend along one [as shown] or both sides of the sheet path 14. Other than as described herein, sheet path 14 may be generally conventional.

This "universal" interconnecting sheet transport module 10 is preferably a fully enclosed, stand-alone, module on its own wheels, as shown, that can be wheeled into position between any two existing or future sheet reproduction machines and sheet output units to be operatively connected for sheet feeding from one to the other. Connection to a normal a.c. power outlet (or a tap from a connecting unit) for the small motor "M" may be provided. A wire harness carrying DFA interface command/control communications and tachometer feedback for motor speed control may also be provided. All that is required for sheet path interconnection is to simply initially adjust (raise or lower) the input and output ends 15, 16 of the sheet path 14 to set them to the respective output and input level of the respective units to be interconnected. This interconnect module 10 then interconnects the paper paths of the two units. i.e., feeds sheets from the output of one unit to the input of the other unit, irrespective of their levels. As shown, the module 10 is connecting the output of any printer or copier 12 to the input of any selected on-line finisher, sorter or other output accessory 11, to eliminate any operator sheet handling therebetween.

This example UIM 10 provides a desirably simple. linear, through sheet transport path 14 designed to accommodate (adjust to) printer output heights over a range of about 560 mm to 1021 mm, measured from floor level, and comparable adjustability of its output level or height, to be able to mate with almost any known finishing devices and/or sorters or mailboxes. That range was selected by reviewing different equipment level requirements. Thus, this universally adaptable paper path interface module 10 can operatively attach to almost any reproduction unit even though they have individually widely different input and output heights and directions [output ends or sides] to deliver the documents to almost any designated feeding or finishing equipment at a different height. The exemplary system is thus compatible (retrofitable) with almost all existing copiers or printers and also future IOT's with input paper and output document paper path heights anywhere within this selected range from 560 mm (22 inches) to 1021 mm (40 inches) measured from the floor. Of course, this lower range level could be decreased even further if needed, and with a taller UIM, this upper range level can be further increased also.

As noted, this future compatibility permits the design of new machine paper paths without compromise to standard output heights, for substantial savings in development costs, and without limiting the designer's ability to adequately optimize the entire paper path.

Referring further to this example of a simple input and output height adjustability system in this UIM 10, here, input and output path ends or "Y" baffle units, 15,

16 are provided at the opposite ends of the sheet feeding path 14, at opposite sides of the UIM 10. They are not, however, separately called inputs or outputs here, since they can desirably reverse those functions. They are individually adjustable in height independently of one another. These sheet feeding end slot units 15 and 16 in this example are each simply held in place by integral threaded pins 17 that manually slide up and down in slots 18, and are locked in position simply by manual knobs 19 thereon that frictionally hold sheet path 14 ends 15, 16 at their respective selected heights when knobs 19 are rotatably tightened. Alternatively, high friction (brake) tracks may be provided, with no locking system, or toothed vertical tracks with a releasable ratchet engagement .

The path 14 ends 15, 16, may have "Y" or "V" shaped receiving or guiding-in baffles. This helps insure effective intercepting of the upstream incoming sheets, and guiding them into the first path 14 roller 13 nip, especially in those installations in which the angle of inclination of path 14 relative to the connecting unit is severe. Likewise at the path 14 output. the baffle helps paper to be directed downstream into the downstream receiving unit nip irrespective of that path connection angle. Optionally, each said "V" or "Y" paper guide or entrance mouth can be designed to adjustably pivot around that respective end roll 13 shaft (e.g., be held in place by a tight fit with the shaft ends), or the baffle 20 end, so that it may be set at a proper or desired angle by the installer or tech rep at installation, when the transport 14 height and angle is set as described herein.

This sheet input and/or output 15, 16 vertical repositioning also automatically moves therewith (and extends or contracts) the connecting telescoping baffles 20 of the feed-through path 14. Here, it also moves the sheet path 14 drive rollers 13 and motor M, which are connected to baffles 20. That is, here the path 14 feed rollers 13 and their drive motor "M" desirably automatically move with those input and output units 15, 16, as shown in phantom in Fig. 1. This is so that if the input 15 goes up while the output 16 goes down, or vice versa, or not, the entire paper path 14 may automatically adjust, incline and become substantially longer than the length of a horizontal (level) paper path connection through the UIM 10, and also vertically reposition. Thus, a light-weight sheet path 14 and motor M is desirably provided for ease of path 14 adjustment, and module 10 stability.

The increase A' in the path 14 length, as that path 14 inclines, is the square root of the sum of the squares of the UIM 10 width A and the then-selected entrance to exit 15 minus 16 height differential B; minus A (since A is also the minimum (horizontal) path length). This increase A' in path length can be substantial. However, it is transparent to the user, since it is automatically provided.

It may be seen that the relative and maximum increase or difference A'-max (between the minimum A and maximum A + A' path 14 length) increases for a narrower UIM 10. Yet, the UIM should be as narrow as possible, to save overall office space and allow more machine locations to be used. The designed width and height of the UIM module thus may vary depending on the maximum extent of the height differences it must accommodate. However, the manufactured UIM width is desirably a single constant width of preferably less than about 40 cm (16 inches) or so, and preferably only about 30 to 40 cm in width. That allows the UIM 10 to still be self-standing (relatively stable), but adds little overall length to the units it interconnects. Thus, the path 14 length varies greatly depending on the input/output entrance 15, 16 level differential.

This change in path 14 length may also affect the desired number of sheet feeding nips in path 14. More and closer drive rollers 13 may be provided, especially if it is desired to positively feed through small (in the feeding dimension) sheets. such as envelopes fed in long-edge first or landscape orientation. That way the path 14 may desirably accommodate a full range of sheet products as well as accommodating a maximum extension of the path 14 length (when the input and output 15, 16 are furthest apart) without losing positive sheet feeder 13 nip engagement.

A standard UIM 10 height of about 92 cm: (36 inches) may be used. If desired, the UIM top cover may pivot up (and be retained up) at at least one side together with that end of the paper path 14, to increase its height range on that side, and/or for jam clearance or repair access.

One example of optional means to fully enclose the UIM 10 yet allow the desired unimpeded path repositioning movement is also noted. One or both of the sides of the UIM 10 having the end unit 15, 16 may be connected to (above and below the sheet entrance slot) a flexible, heavy plastic or tambour curtain wall or "windowshade," respectively. As the end units 15 or 16 reposition, their connected said "windowshades" can automatically unroll and roll up on spring loaded rollers at the top and bottom of unit 10. The respective side edges of these windowshades may be slideably supported in channels or tracks in the UIM 10 frame. Thus, the input and output sides of the UIM 10 can remain safely enclosed at all times irrespective of the repositioning of input and/or output levels thereon. Of course, a side of unit 10 docked directly adjacent a sidewall of a unit 11 or 12 is blocked thereby, and does not need its own sidewall. The motor M can also be interlocked not to run unless so docked.

To readily accommodate or match UIM sheet feeding speed to the print engine output, a variable speed motor "M" driving the sheet feed transport path 14 rollers 13 is desirable. It may be speed controlled by a tachometer feedback system, or the feeding speed may be set by the installer, or automatically set from a conventional sheet path sheet edge sensor 25 or 26 at the incoming sheet input side (15 or 16) of the UIM, which can detect

the time between incoming sheets in a conventional manner. The sensors 25, 26 may also conventionally provide sheet jam sensing, by monitoring the sheet feeding time from one sensor at one end of path 14 to the other. The sensors 25, 26 may be conventionally connected to a conventional programmable controller 100, as shown in Fig. 3. Controller 100 can also provide speed and reversibility control for drive motor M.

This input sensing by sensors 25 or 26 can also be used to automatically reverse the sheet feeding direction for left or right paper input feeding. Although as noted below, the reversal of UIM sheet feeding direction could alternatively be accomplished by reversing the unit, a drive belt, or some other modification at installation, a single variable speed/reversible motor M accomplishes both functions.

That is, to be fully "universal", to accommodate printers with either right side or left side sheet outputs. as well as any output level. the sheet feeder path 14 through the UIM 10 is desirably easily reversible. As conventionally viewed from the front. if the UIM is operatively connecting to a left side or end output of a printer (to feed sheets to a left-side connected sorter, mailbox. finisher or other output processor). the feed path 14 rollers or belts are driven so that the UIM 10 feeds sheets from right to left through the unit. For operatively connecting to the right side or end of a printer, the unit feeds sheets from left to right. This can be provided by the reversible drive motor "M" reversing the feed rollers 13. The motor M reversal can be by an installer or operator switch therefor. Or. as noted, motor M direction can be automatically switched by sensing which sheet sensor 25 or 26 is first activated. However, reversal could also be provided by a clutch or reversible belt drive easily changed by the tech rep or machine installer at the time of installation. E.g., a drive belt between the drive motor "M" and its driven feed rollers 13 may be re-mounted in a "figure 8" path rather than the normal belt loop path to provide drive reversal in a known manner.

For bi-directional feeding, the baffles 20 are designed not to catch or stub sheet edges in either direction, even at a telescoping or sliding overlap area. This can be done. by interdigitating baffle fingers or extensions mating with turned-down ends with baffle cut-outs or notches, in a known manner, or otherwise. A type of telescoping "tongue and groove baffle 20 is shown here which is bi-directional. The feed rollers 13 are shown driven by a belt tensioned by a movable "dancer roll" to accommodate the sheet path 14 length changes and maintain driving of the rollers 13 at the ends of the path 14. If desired, these end rollers 13 may also have an adjustable nip orientation, as shown in phantom in Fig. 4. As also shown, (especially Figs. 1 and 3) the (top) idler roll of the central roller 13 may be pivotally mounted to lift up for jam clearance.

Alternatively, the UIM can be designed to be installed in mirror image, that is, with the UIM being front to back reversible, so as to reverse both the paper path feed direction and the sheet input and/or output in that manner. In that case, the sheet feed path therethrough can be conventionally unidirectional. This reversibility can be provided by a unit 10 rear cover attractive enough in appearance to be used as the unit 10 front cover; or front and rear covers which can be easily removed and interchanged. This has the added advantage of only requiring a printer 12 output level adjustment range on one (consistent) side of the unit 10, and only the desired output device 11 input height range on the other side of the unit 10, rather than providing the maximum range for either on both sides.

Another optional feature of an interface unit 10 is to provide optional additional on-line sheet treatment subsystems in the UIM module sheet path itself, or in an input path thereto, or in various inter-connected output devices 11, or combinations thereof. These functions can include, for example, a sheet rotator, sheet inverter. sheet hole punch, signature folder, Z-folder, sheet inserter, purge tray, etc., or combinations thereof. These are all well known, per se, and need not be shown in detail here They may be located in a removable and replaceable sub-module, so as to be able to easily meet various customer needs by easily substituting one such functional unit or sub-unit for another.

For example, in general, sheet rotators operate by moving one side of the sheet faster than the other. by holding or much more slowly feeding the sheet in one sheet feed nip on one side of the feed path than the other (as with a variable speed motor or drive) until the sheet rotates 90 degrees. That allows a choice of sideways or end-wise sheet bin or tray finishing and/or stacking, such as selection of the side of the copy set to be stapled. Sheet rotators are shown, for example, in U.S. 5,090,638; 3,861,673; 4,473,857; 4,830,356 and 5,145,168; and some of them are shown in interface modules.

If a large, e.g., 17 inch, sheet is signaled by the printer 12 as being sent, or detected by UIM sheet path sensors, such as 25, 26, then such a sheet can be rotated by a sheet rotator in the sheet path as described above, so as to ultimately stack short-edge first in an output unit 11 bin. Alternatively, if a sheet folder is provided in the sheet path, the large sheet can be folded before stacking. Thus, the sorter or mailbox bins need not be oversized just to accommodate such abnormal large size sheets.

As further examples of on-line reproduction machine output sheet processing units and functions, U.S. 4,602,775 and U.S. 5,172,162 show an interface module with an inverter or other sheet processor between a printer or copier and a sorter, finisher, or other output unit. Examples of on-line Z-fold and other sheet folder systems are in U.S. 5,026,556. Examples of on-line sheet hole punching units include U.S. 4,819,021; 4,998,030 and 4,763,167. Examples of sheet inverter patents include U.S. 3,833,911; 3,917,257; 4,359,217; and 4,673,176. The first two show an optional inverter

in association with a sorter, as in the Xerox Corporation "4500" copier. Examples of cover or other sheet inserters, etc., are disclosed in the Xerox XDJ publication of November/December 1991, pages 381-383; and U.S. 4,626,156; 4,924,265; 5,080,340; and 4,602,776. Sheets may be fed from various sheet trays and feeders at times selected by the printer or controller to be interposed (interleaved) with job sheets from the printer going into the same sheet path to the same stacker and/or compiler/stapler.

Note that if sheet path side registration is desired in the disclosed UIM sheet path 14, (or before or after) that can also be provided. Examples of sheet feeding side registration systems and hardware include U.S. 4,487,407; 4,411,418; 4,621,801; 4,744,555; 4,809,968; 4,919,318. and 5,065,998.

Another possible option is a selectable face up or face down inverter/stacker. One example is described in U.S. Patent Nos. 5.201,517.

Note that the sheet processing output modules 11 can also provide an alternate, gated, by-pass sheet feeder path on through the module or unit 11 into another unit 11 for increased bin capacity or further such sheet processing options. as is well known for ganged sorter units.

Alternatively. as shown in Fig. 6. for example, another UIM 10 can be used to operatively connect between two units 11, such as a finisher unit and a mailbox and/or stacker unit. Or. a UIM 10 may be used at a printer 10 input to connect a high capacity sheet feeder to a printer clean sheet input.

The UIM can thus connect with or provide interposer functionality for a host of paper handling accessory features or systems such as: finishers (staplers stitchers, glue binders, etc.), cover or tab inserters, sheet inverters or rotators, hole punches, sheet folders (center, signature, or "Z-fold"), hicap feeders, slitter/perforators, booklet makers, etc.. A multitude of other post processing options can also be employed in or on the UIM, or in units it provides sheet feeding connections to, such as: MICR tape stamping [e.g., as described in U.S. 5,083,157], Color foil/holographic foil application, UV ink annotation, Bar codes for scanning, MICR for magnetic reading, etc.. [Note, e.g., U.S. 5,083,157 and U.S. 5,178,162].

Merely as a few examples of existing commercial output devices presently employing separate and unique interfaces which could all be replaced by one UIM are the: Xerox DT 135 / BOURG SBM with dual output height of 1021/860mm, now accommodated by a unique left to right transition module; the 9790 MICR/ BOWE-SYSTEC inserter with unique input transport elevating Xerox "9790" duplicator output from 940 mm to over 1100 mm right to left; and the Xerox "4135" /Bell & Howell "Mailstream" with a bypass transport moving 4135 output from 1418 mm to 860 mm left to right. Also, the Xerox "DocuTech" 135 Signature Booklet Maker, which adapts to "5090" / DT135, 860 mm and 1021 mm output heights, but is not adjustable nor adaptable to other copier/printer outputs. They are all somewhat adjustable, for floor level/mismatch etc., but are all for a specific printer output to a specific finishing application in height and direction.

Claims

1. A universal interface for operatively connecting and feeding the sequential copy sheet output of various selectable reproduction apparatus (12) of widely varying ranges of sheet output level heights and direction to various selectable independent copy sheet processing modules (11) having widely varying sheet input level heights, comprising:

   a free-standing movable universal interface module (10) of a fixed width;
   said free-standing universal interface module (10) providing a repositionable sheet feeding path (14) therethrough. from one side to the other of said module (10), for transporting said copy sheet output of said selected reproduction apparatus (12) to said sheet input of said selected copy sheet processing module (11);
   said repositionable sheet feeding path (14) through said universal interface module (10) including integral vertically repositionable sheet receiving or sheet discharging sheet path ends (15,16) opening at opposite sides of said interface module (10), which sheet path ends (15,16) are readily independently repositionable over a large vertical height range; and
   a retention system (17,18,19) for retaining said sheet path ends (15,16) at selected height positions mating with a selected reproduction apparatus sheet output level and a selected copy sheet processing module sheet input level so that said repositionable sheet feeding path is operatively connecting therebetween to feed sheets from said reproduction apparatus (12) to said copy sheet processing module (11).

2. A universal interface as claimed in claim 1, wherein said repositionable sheet feeding path (14) through said universal interface module (10) provides selectably reversible feeding of said copy sheets therethrough in either direction.

3. A universal interface as claimed in claim 2, wherein said sheet feeding path (14) has an automatically reversing sheet feed drive

4. A universal interface as claimed in any one of claims 1 to 3, wherein said repositionable sheet feeding path (14) has a variable path length which is varied automatically with the vertical repositioning of the

path ends (15,16).

5. A universal interface as claimed in claim 4, wherein said sheet feeding path (14) is defined by telescoping baffles (20) automatically telescoping to provide changes in said sheet feeding path length.

6. A universal interface as claimed in any one of claims 1 to 5, wherein said sheet feeding path (14) through said interface module (10) remains substantially linear irrespective of the vertical repositioning of the path ends (15, 16).

7. A universal interface as claimed in any one of claims 1 to 6, wherein said universal interface module (10) has a constant width of less than about 40 cm.

8. A universal interface as claimed in any one of claims 1 to 7, wherein at least one of said sheet path ends (15, 16) of said interface module sheet feeding path (14) is vertically repositionable over a vertical height range of at least approximately 50 to 100 cm.

9. A universal interface as claimed in any one of claims 1 to 8, wherein said repositionable sheet feeding path (15, 16) comprises a variable speed sheet feed drive (100, M, 13) automatically adjusting to sheet input speed.

Patentansprüche

1. Universal-Interface zum betriebsmäßigen Verbinden und Zuführen der sequentiellen Kopieblatt-Ausgabe verschiedener auswählbarer Reproduktions-Geräte (12) von sich weit variierenden Bereichen von Blatt-Ausgabe-Niveau-Höhen und -Richtung zu verschiedenen, auswählbaren, unabhängigen Kopieblatt-Verarbeitungs-Modulen (11), die sich weit variierende Blatt-Eingabe-Niveau-Höhen besitzen, das aufweist:

   ein feistehendes, bewegbares Universal-Interface-Modul (10) einer festgelegten Breite;

   wobei das freistehende Iniversal-Interface-Modul (10) einen umpositionierbaren Blattzuführpfad (14) dort hindurch, von einer Seite zu der anderen Seite des Moduls (10), zum Transportieren der Kopieblatt-Ausgabe des ausgewählten Reproduktionsgeräts (12) zu der Blatt-Eingabe des ausgewählten Kopieblatt-Verarbeitungs-Moduls (11) schafft;

   wobei der umpositionierbare Zuführpfad (14) durch das Universal-Interface-Modul (10) integrale, vertikale, umpositionierbare Blatt-Aufnahme- oder Blatt-Ausgabe-Blattpfadenden (15, 16) umfaßt, die sich an entgegengesetzten Seiten des Interface-Moduls (10) öffnen, wobei die Blattpfadenden (15, 16) leicht unabhängig über einen großen, vertikalen Höhenbereich umpositionierbar sind; und

   ein Rückhaltesystem (17, 18, 19) zum Zurückhalten der Blattpfadenden (15, 16) unter ausgewählten Höhenpositionen, die sich an ein Blatt-Ausgabe-Niveau eines ausgewählten Reproduktionsgeräts und ein Blatt-Eingabe-Niveau eines ausgewählten Kopieblatt-Verarbeitungs-Moduls anpassen, so daß der umpositionierbare Blattzuführpfad betriebsmäßig dazwischen verbunden ist, um Blätter von dem Reproduktionsgerät (12) zu dem Kopieblatt-Verarbeitungs-Modul (11) zuzuführen.

2. Universal-Interface nach Anspruch 1, wobei der umpositionierbare Blattzuführpfad (14) durch das Universal-Interface-Modul (10) eine auswählbare, reversible Zuführung der Kopieblätter dort hindurch in irgendeiner Richtung schafft.

3. Universal-Interface nach Anspruch 1, wobei der Blattzuführpfad (14) einen automatisch sich umkehrenden Blattzuführantrieb besitzt.

4. Universal-Interface nach einem der Ansprüche 1 bis 3, wobei der umpositionierbare Blattzuführpfad (14) eine variable Pfadlänge besitzt, die automatisch mit der vertikalen Umpositionierung der Pfadenden (15, 16) variiert wird.

5. Universal-Interface nach Anspruch 4, wobei der Blattzuführpfad (14) durch sich teleskopartig verschiebende Ablenkteile (20) definiert wird, die sich automatisch teleskopartig verschieben, um Änderungen in der Blattzuführpfadlänge zu schaffen.

6. Universal-Interface nach einem der Ansprüche 1 bis 5, wobei der Blattzuführpfad (14) durch das Interface-Modul (10) im wesentlichen linear unabhängig der vertikalen Umpositionierung der Pfadenden (15, 16) verbleibt.

7. Universal-Interface nach einem der Ansprüche 1 bis 6, wobei das Universal-Interface-Modul (10) eine konstante Breite von weniger als etwa 40 cm besitzt.

8. Universal-Interface nach einem der Ansprüche 1 bis 7, wobei mindestens eines der Blattpfadenden (15, 16) des Interface-Modul-Blattzuführpfads (14) vertikal über einen vertikalen Höhenbereich von mindestens ungefähr 50 bis 100 cm umpositionierbar ist.

9. Universal-Interface nach einem der Ansprüche 1 bis 8, wobei der umpositionierbare Blattzuführpfad (15, 16) einen Blattzuführantrieb mit variabler Geschwindigkeit (100, M, 13) besitzt, der automatisch die Blatteingabegeschwindigkeit einstellt.

Revendications

1. Interface universelle pour relier fonctionnellement et charger la sortie de feuilles de copie séquentielle de divers appareils de reproduction (12) pouvant être sélectionnés ayant des gammes variant largement de hauteurs de niveaux de sortie de feuilles et de direction, à divers modules (11) de traitement de feuilles de copie indépendants pouvant être sélectionnés ayant des hauteurs de niveau d'entrée de feuilles variant largement, comprenant :

   un module (10) d'interface universel mobile se tenant de lui-même et de largeur fixe :
   ce module (10) d'interface universel se tenant de lui-même fournissant un trajet (14) de chargement de feuilles pouvant être repositionné le traversant, d'un côté à l'autre dudit module (10), pour transporter ladite sortie de feuilles de copie dudit appareil (12) de reproduction sélectionné à ladite entrée de feuilles dudit module (11) de traitement de feuilles de copie sélectionné :
   ledit trajet (14) de chargement de feuilles pouvant être repositionné par l'intermédiaire dudit module (10) d'interface universel comportant des extrémités (15,16) de trajets de feuilles pour la réception de feuilles ou le déchargement de feuilles pouvant être repositionnées verticalement et de façon intégrale, s'ouvrant sur les côtés opposés dudit module (10) d'interface, lesquelles extrémités (15, 16) du trajet de feuilles peuvent être repositionnées indépendamment l'une de l'autre dans une large gamme de hauteurs verticales ; et
   un système (17,18,19) de rétention pour retenir lesdites extrémités (15,16) du trajet de feuilles à des hauteurs sélectionnées adaptées à un niveau de sortie de feuilles d'appareil de reproduction sélectionné et à un niveau d'entrée de feuilles de module de traitement de feuilles de copie sélectionné, de façon que ledit trajet de chargement de feuilles pouvant être repositionné les relie fonctionnellement afin de charger des feuilles dudit appareil (12) de reproduction audit module (11) de traitement de feuilles de copie.

2. Interface universelle selon la revendication 1, dans laquelle ledit trajet (14) de chargement de feuilles pouvant être repositionné passant par l'intermédiaire dudit module (10) d'interface universel assure un chargement réversible, de façon pouvant être sélectionnée, desdites feuilles de copie à travers celui-ci, dans un sens ou l'autre.

3. Interface universelle selon la revendication 2, dans laquelle ledit trajet (14) de chargement de feuilles a un dispositif d'entraînement de chargement de feuilles s'inversant automatiquement.

4. Interface universelle selon l'une quelconque des revendications 1 à 3, dans laquelle ledit trajet (14) de chargement de feuilles pouvant être repositionné a une longueur de trajet variable qui est modifiée automatiquement avec le repositionnement vertical des extrémités (15,16) du trajet.

5. Interface universelle selon la revendication 4, dans laquelle ledit trajet (14) de chargement de feuilles est défini par des chicanes (20) télescopiques se télescopant automatiquement pour produire des modifications de longueur du trajet de chargement de feuilles.

6. Interface universelle selon l'une quelconque des revendications 1 à 5, dans laquelle ledit trajet (14) de chargement de feuilles passant par l'intermédiaire dudit module (10) d'interface reste sensiblement linéaire, quel que soit le repositionnement vertical des extrémités (15,16) du trajet.

7. Interface universelle selon l'une quelconque des revendications 1 à 6, dans laquelle ledit module (10) d'interface universel a une largeur constante inférieure à environ 40 cm.

8. Interface universelle selon l'une quelconque des revendications 1 à 7, dans laquelle au moins l'une desdites extrémités (15,16) dudit trajet (14) de chargement de feuilles du module d'interface peut être repositionnée verticalement dans une gamme de hauteurs verticales d'au moins environ 50 à 100 cm.

9. Interface universelle selon l'une quelconque des revendications 1 à 8, dans laquelle ledit trajet (15,16) de chargement de feuilles pouvant être repositionné comprend un dispositif d'entraînement (100,11,13) de chargement de feuilles à vitesse variable s'ajustant automatiquement à la vitesse d'entrée des feuilles.

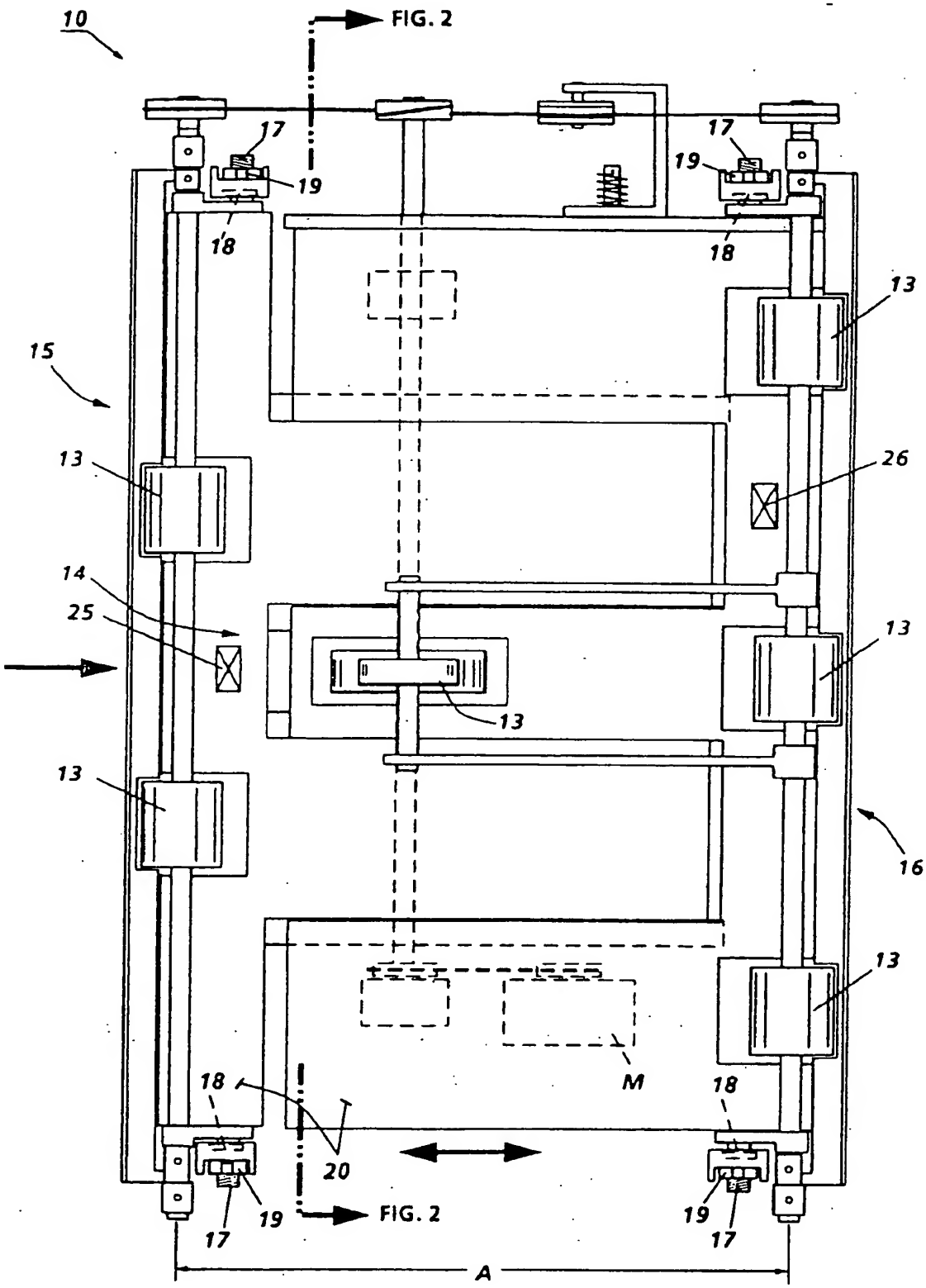
10
FIG. 2
17
19
18
17
19
18
13
15
13
26
14
25
13
13
13
16
13
M
18
18
20
19
17
FIG. 2
19
17
A

FIG. 1

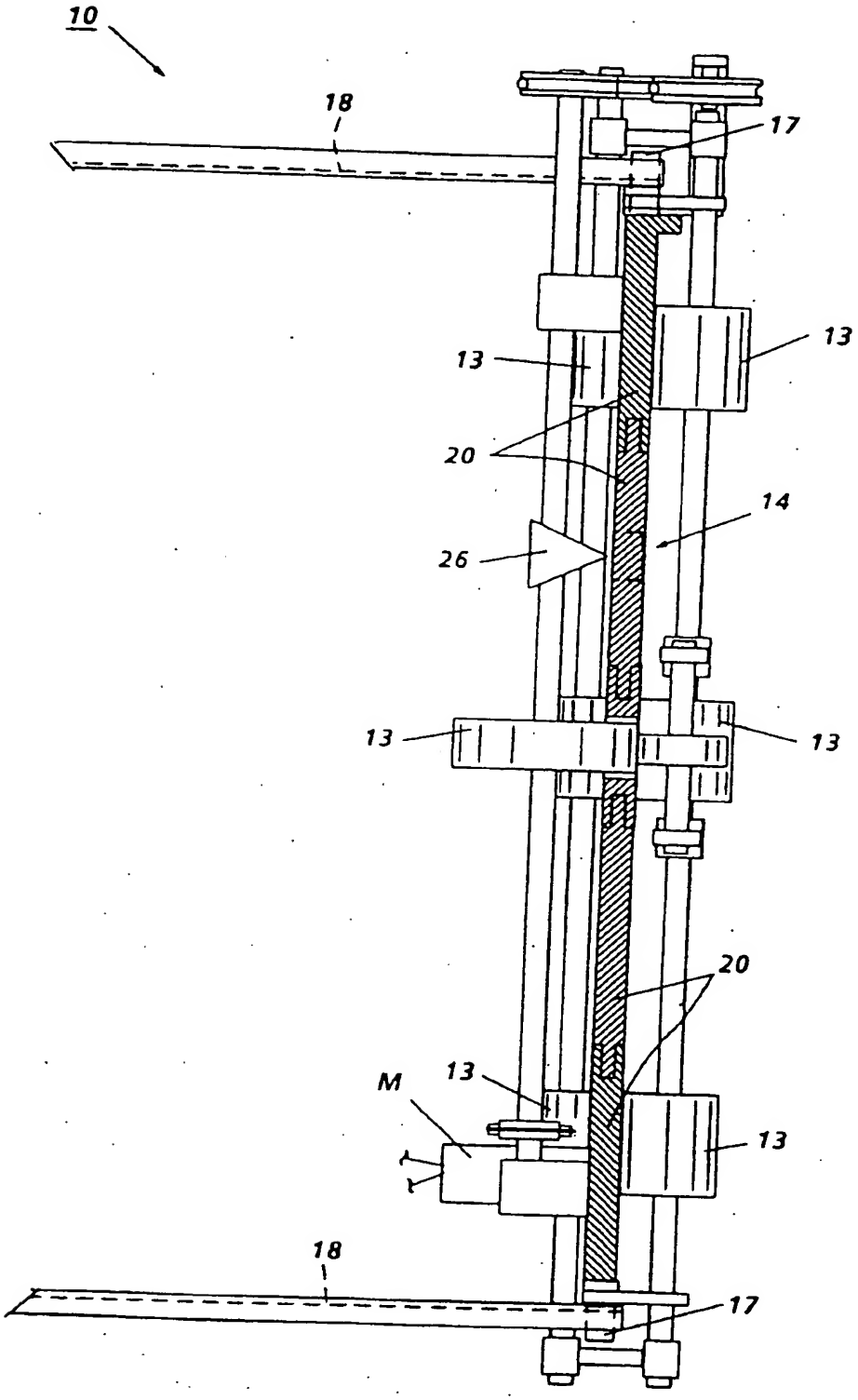

FIG. 2

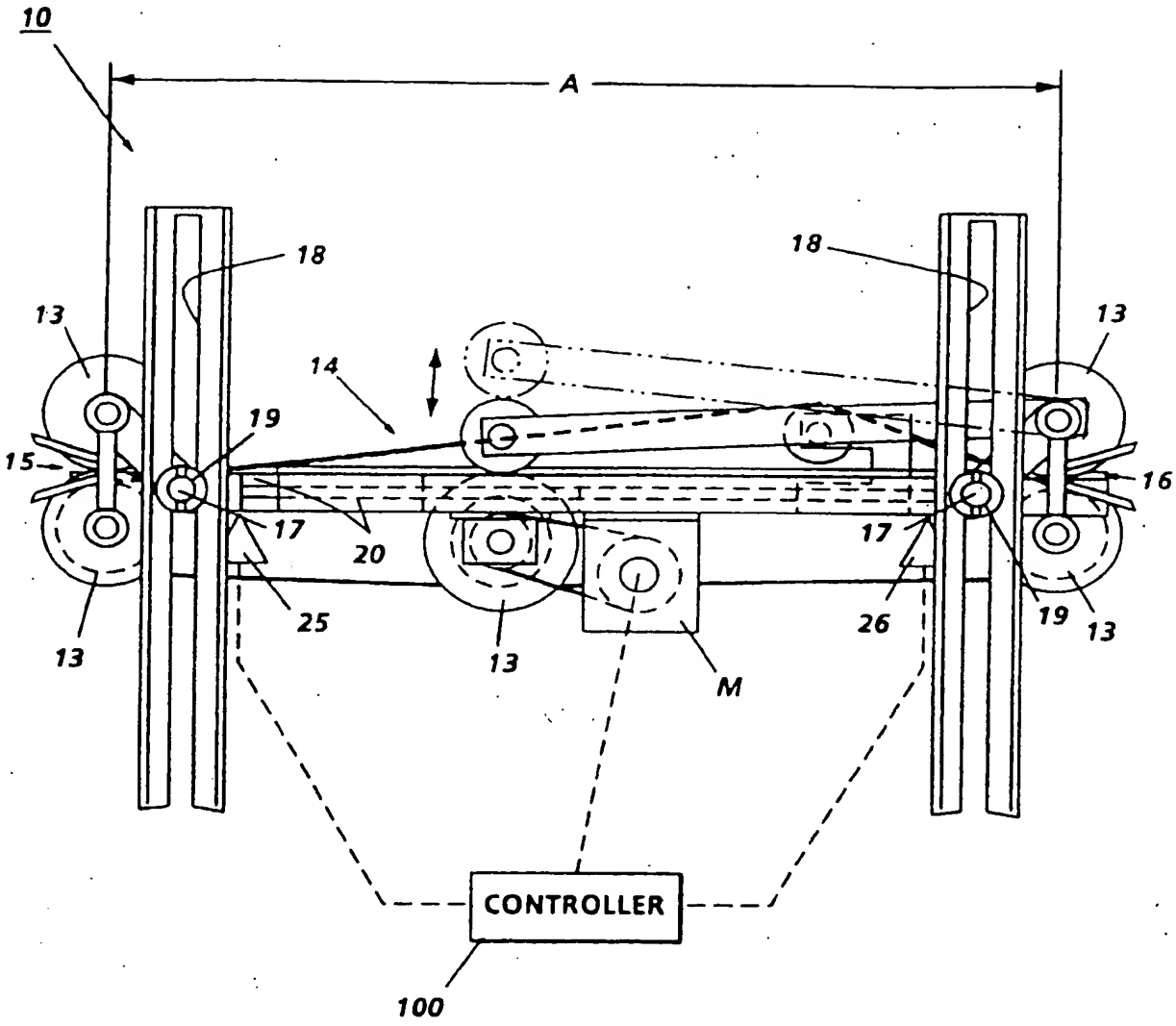
10
A
18
18
13
13
14
19
15
16
17
17
20
25
26
19
13
13
13
M
CONTROLLER
100

FIG. 3

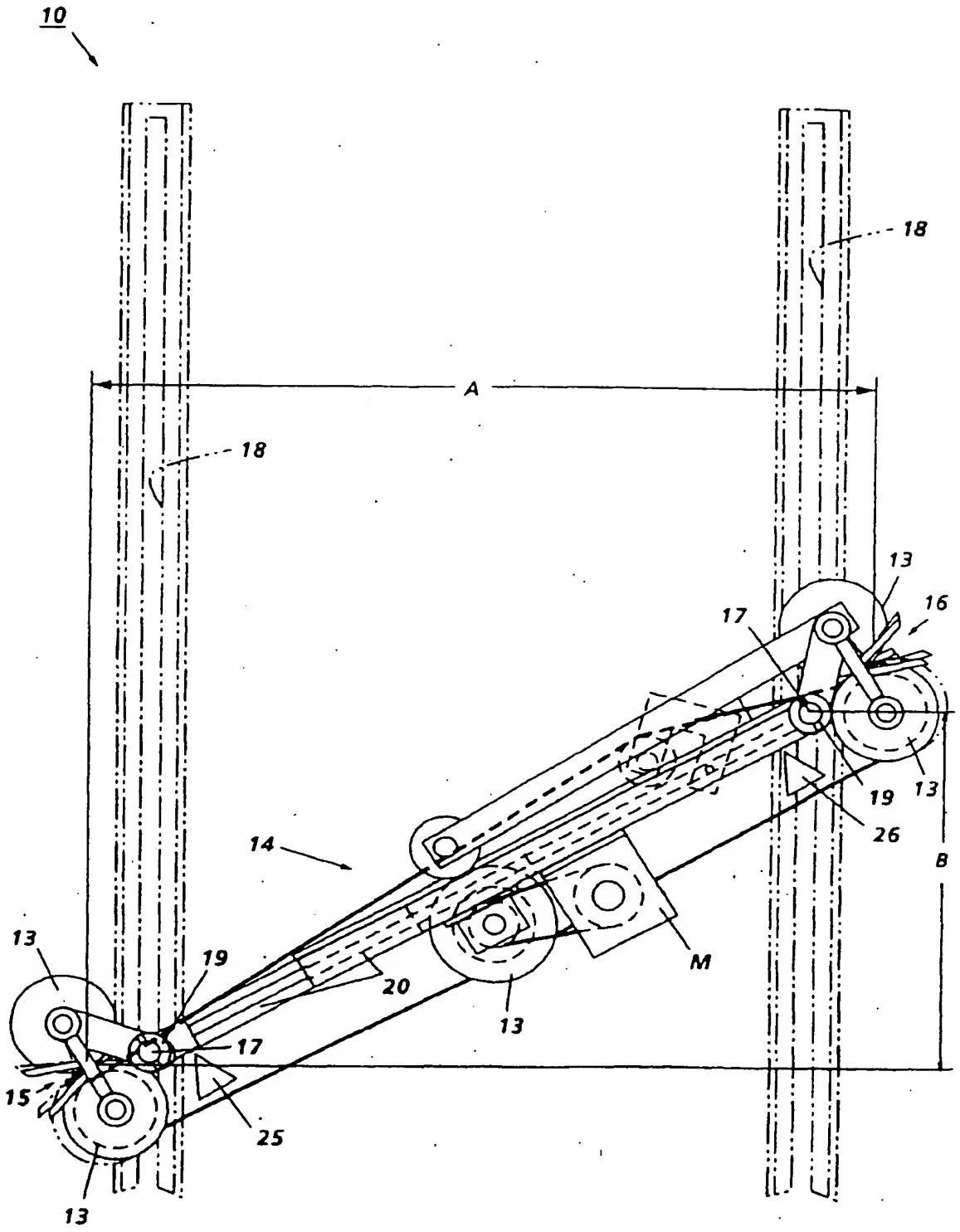

FIG. 4

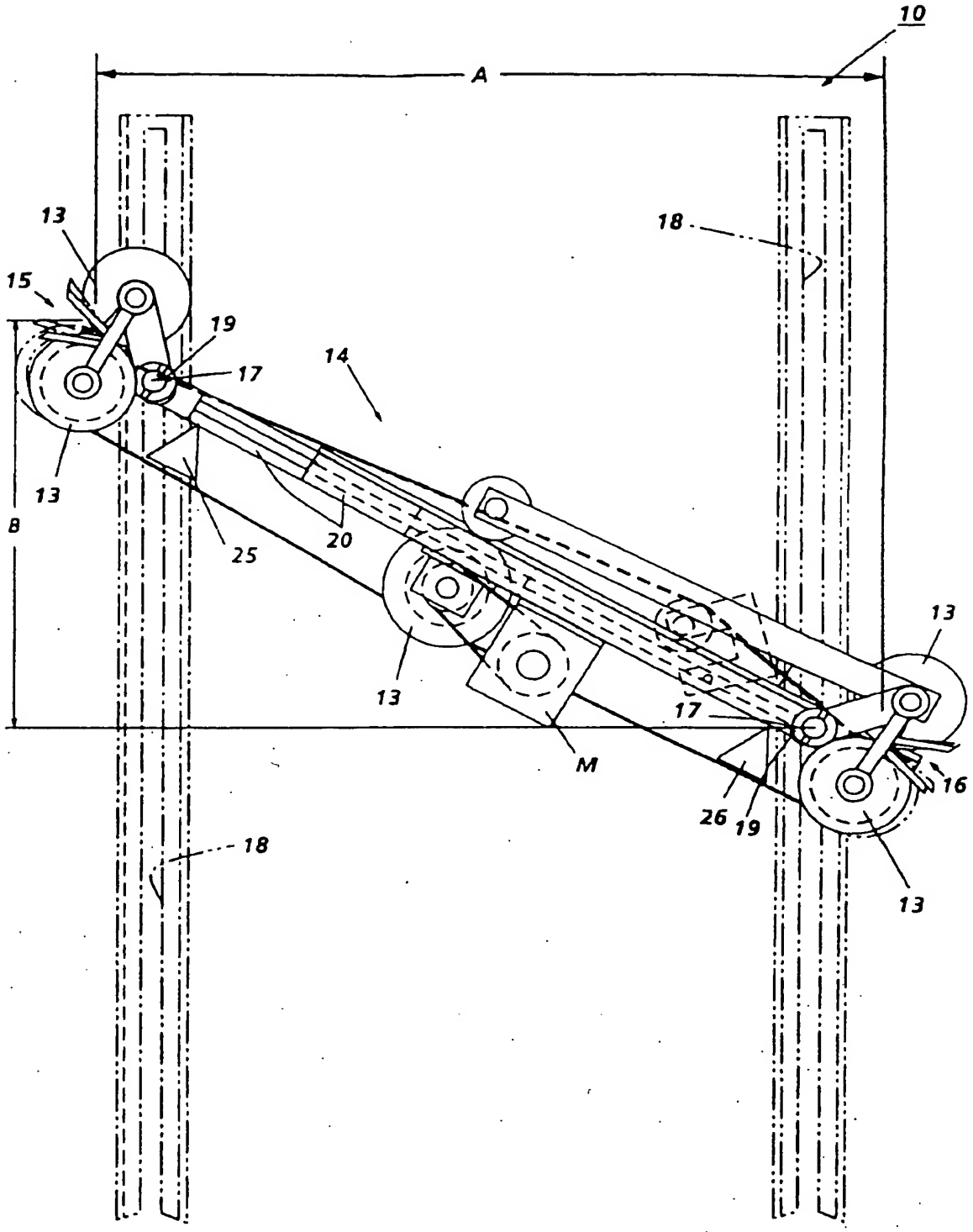

FIG. 5

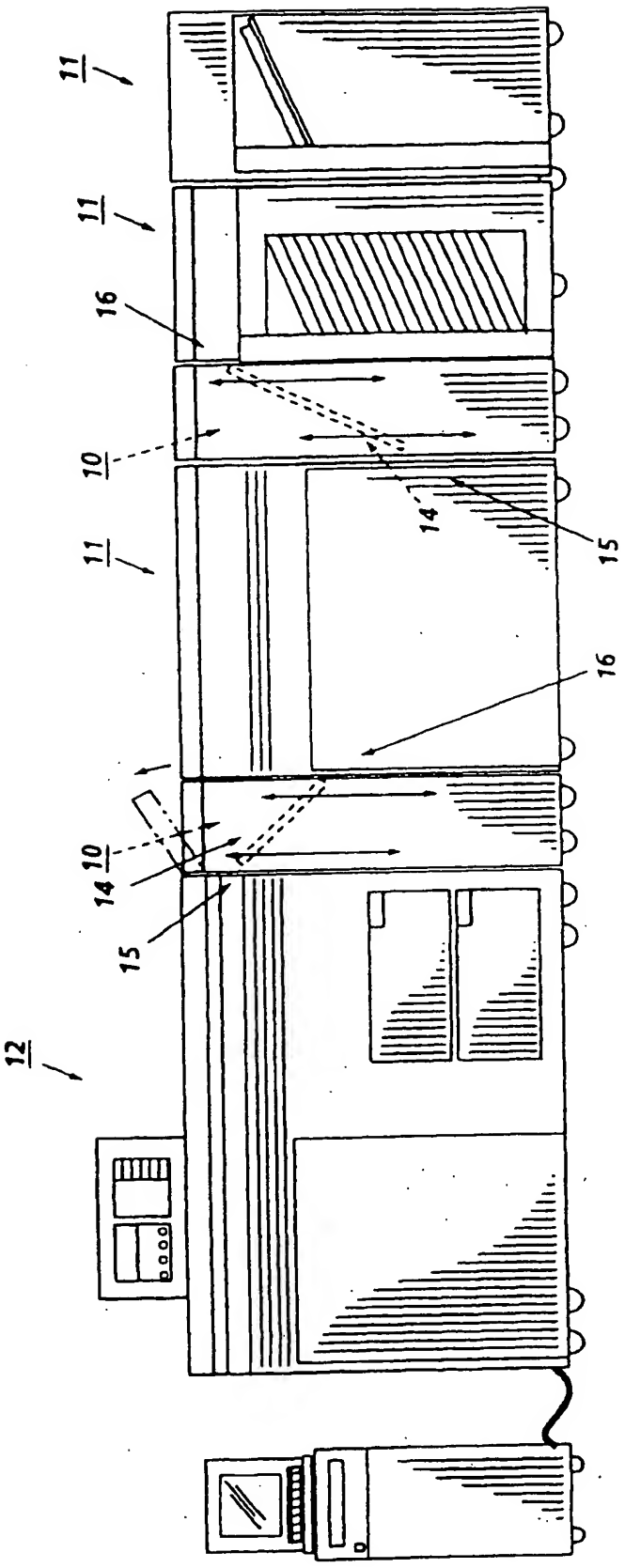

FIG. 6